

CLAIMS

What is claimed is:

- Sub A 7
- 1 1. A method of producing a representation of a streaming media data at a
2 caching proxy server, said method comprising:
3 transmitting a request for streaming media data to be delivered to said
4 caching proxy server;
5 transmitting a request for data associated with said streaming media
6 data, said request including an identifier which represents one of several
7 possible types of data associated with said streaming media data;
8 receiving said streaming media data and storing said streaming media
9 data on a storage device which is capable of being controlled by said
10 caching proxy server; and
11 receiving said data associated with said streaming media data.
 - 1 2. A method as in claim 1 further comprising:
2 storing said data associated with said streaming media data in said
3 storage device.
 - 1 3. A method for data transmission from a server data processing system ,
2 said method comprising:

Sub A'7

1 8. A method of claim 7, wherein the extensible extended header comprises
2 an extension name and an extension identification (ID) associated with each
3 separate RTP extension.

1 9. A method of claim 3, wherein request may be for one or more type of
2 transmission protocol data at a time.

1 10. A method of claim 3, wherein the response by the server comprising
2 response for each supported transmission protocol data and no response for
3 any unsupported transmission protocol data.

1 11. A method of claim 3, further comprising receiving a request to send the
2 transmission protocol data after sending a response for supported data, and
3 sending only the requested and supported transmission protocol data.

1 12. A method for operating a caching proxy server comprising:
2 sending a request for streaming media data to a server, said request
3 including a request for data associated with said streaming media data, said
4 request including an identifier which represents one of several possible types of
5 data associated with said streaming media data,
6 receiving a response from the server indicating support for the requested
7 streaming media data;

Sub A 7

8 informing the server to send the supported data associated with said
9 streaming media data;
10 receiving the streaming media data from the server;
11 receiving a request from the client to send streaming media data; and
12 sending the requested streaming media data to the client.

1 13. A method of claim 12, wherein said receiving and sending uses a real-
2 time transport protocol (RTP).

1 14. A method of claim 12, wherein said receiving streaming media data from
2 the server is in an extensible extended header format.

1 15. A method of claim 12, wherein said sending a request may be for one or
2 more various and unrelated types of streaming media data to be sent at a time.

1 16. A method of claim 12, wherein said response from the server comprising
2 response for each supported type of streaming media and no response for any
3 unsupported types of streaming media data.

1 17. A method of claim 14, wherein said extensible extended header format
2 is appended before sending to client.

Sub A' 7

1 18. A method of claim 17, wherein, appending comprising stripping of name
2 and ID part of the extensible extended header.

1 19. A method of claim 12, further comprising determining if a requested
2 type of streaming media data, that which is required by a caching proxy server
3 to be able to perform its processes, is missing in the response by the server.

1 20. A method of claim 19 further comprising terminating the data
2 transmission process if the requested type of streaming media data is missing in
3 server's response and is critical to the data transmission process.

4 21. A method for extending an RTP header comprising:
5 adding a first RTP sub-extension ID to an RTP header;
6 defining a length of said first RTP sub-extension by providing a sub-
7 extension length;
8 providing data corresponding to the RTP sub-extension ID within said
9 length defined for said first RTP sub-extension; and
10 having subsequent RTP sub-extensions following the first RTP sub-
11 extension.

1 22. A method of claim 21, wherein the length of the RTP sub-extension being
2 defined by a whole number of 32 bit words.

Sub A 7

1 23. A method of claim 21, wherein the first RTP sub-extension immediately
2 following the RTP header.

1 24. A method of claim 21, wherein RTP sub-extension length is immediately
2 followed by RTP sub-extension data and immediately preceded by RTP sub-
3 extension ID.

1 25. A method of claim 21, wherein the RTP sub-extension contains transmit
2 time information of each RTP packet.

1 26. A method of claim 21, wherein the RTP sub-extension contains persistent
2 ID information.

1 27. A method of claim 21, wherein the RTP sub-extension contains Frame
2 Type information.

1 28. A method of claim 27, wherein the frame type being a 16-bit unsigned
2 integer value representing a different frame for each value.

1 29. A method of claim 28, wherein unsigned integer and frame type
2 comprising:

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3 assigning an integer value of "0" to an unknown frame type; an integer
4 value of "1" to a key frame type; an integer value of "2" to a p-frame type; and
5 an integer value of "3" to a b-frame type.

1 30. A method of claim 29, wherein said key-frame being most important in
2 priority than any other frames.

1 31. A method of claim 29, wherein said p-frame being less important in
2 priority than key-frame, and more important in priority than b-frame.

1 32. A method of claim 29, wherein said b-frame being less important in
2 priority than p-frame.

1 33. A method of claim 29, wherein said b-frame being less important in
2 priority than key-frame.

1 34. A method of claim 29, wherein said unknown-frame being either more
2 or less important in priority than key-frame, p-frame and b-frame.

1 35. A method of claim 29, wherein said key-frame being more important in
2 priority than p-frames, b-frames, and any other frames.

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1 37. A method of claim 36, further comprising receiving a request to send
2 supported RTP extensions to the caching proxy or the client.

1 38. A method claim 37, further comprising responding to request to send
2 and sending all the supported and requested extensions.

1 39. A method of claim 36, further comprising receiving a command
2 terminating the negotiation process.

Sub A 7

1 40. A method of negotiating for various types of streaming media data by
2 the caching proxy server comprising:
3 sending a request for one or more types of related or unrelated
4 streaming media data to a server, said request including a request for data
5 associated with said streaming media data, said request including an identifier
6 which represents one of several possible types of data associated with said
7 streaming media data;
8 receiving a response to each requested type of streaming media data;
9 and
10 deciding whether to proceed or terminate negotiation process associated
11 with streaming media data.

1 41. A method of claim 40, wherein deciding comprises:
2 determining if any requested type of streaming media data is not
3 supported by server;
4 checking if unsupported type of streaming media data is essential to
5 caching proxy server operations; and
6 sending an execution command to server.

1 42. A method of claim 40, wherein determining supported types of
2 streaming media data being performed by checking if a response in a form of
3 an echo or otherwise has been sent for requested type of streaming media data.

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- 1 47. A method of claim 46, wherein said evaluating comprising:
2 naming unsigned integers to frame types;
3 assigning an integer value of "0" to an unknown frame type; an integer
4 value of "1" to a key frame type; an integer value of "2" to a p-frame type; and
5 an integer value of "3" to a b-frame type.

567 A^c 7

- 1 (48. A method of claim 47, wherein said key-frame being most important in
2 priority than any other frames.
- 1 49. A method of claim 47, wherein said p-frame being less important in
2 priority than key-frame, and more important in priority than b-frame.
- 1 50. A method of claim 47, wherein said b-frame being less important in
2 priority than p-frame.
- 1 51. A method of claim 47, wherein said b-frame being less important in
2 priority than key-frame.
- 1 52. A method of claim 47, wherein said unknown-frame being either more
2 or less important in priority than key-frame, p-frame and b-frame.
- 1 53. A method of claim 47, wherein said key-frame being more important in
2 priority than p-frames, b-frames, and any other frames.
- 1 54. A method of claim 46, further comprising:
2 receiving a second message from a client to further thin streaming
3 media data;

Sub A 7
4 processing message and eliminating more selected streaming media data
5 and sending streaming media data of higher priority.

1 55. A method of claim 54, wherein said selected streaming media
2 frame being eliminated being a b-frame, and sending streaming media data
3 with higher priority than b-frame to the client.

1 56. A method of claim 54, wherein said streaming media data being
2 eliminated being a p-frames and b-frame, and sending frames with higher
3 priority than both p-frames and b-frames to the client.

1 57. A method of frame thinning by client comprising:
2 sending a message to a caching proxy server, said message indicating a
3 need to thin streaming media data received at said client;
4 receiving media back from said caching proxy server that are higher in
5 order than low order streaming media data.

1 58. A method of claim 57, further comprising:
2 sending a subsequent message from a client to further thin streaming
3 media data;
4 receiving streaming media data that is higher in order then previous
5 streaming media data received.

1 59. A method of claim 57, further comprising:
2 assigning an unsigned integer to a frame associated with streaming
3 media data, wherein said assigning further comprising assigning an integer
4 value of "0" to an unknown frame type; an integer value of "1" to a key frame
5 type; an integer value of "2" to a p-frame type; and an integer value of "3" to a
6 b-frame type.

1 61. A method of claim 59, wherein said p-frame being less important in
2 priority than key-frame, and more important in priority than b-frame.

63. A method of claim 59, wherein said b-frame being less important in priority than key-frame.

64. A method of claim 59, wherein said unknown-frame being either more or less important in priority than key-frame, p-frame and b-frame.

1 65. A method of claim 59, wherein said key-frame being more important in
2 priority than p-frames, b-frames, and any other frames.

1 66. A method of claim 58, wherein said sending comprising eliminating p-
2 frames and sending selected streaming media data that is higher in order than
3 p-frames to the client.

1 67. A method of claim 58, wherein said sending comprising eliminating both
2 p-frames and b-frames, and sending selected streaming media data that is
3 higher in order than both p-frames and b-frames.

68. A method of using transmit time of RTP packet transmissions at a caching proxy server said method comprising:

- requesting data corresponding to transmit time for streaming media data from a server;
- receiving said streaming media data and corresponding transmit time information from the server;
- storing the received information; and
- transmitting from said caching proxy server to a client said streaming media data at times specified by said transmit time.

5 receiving a request for streaming media data, said request including a
6 request for data associated with said streaming media data, said request
7 including an identifier which represents one of several possible types of data
8 associated with said streaming media data;
9 responding to the request with a response indicating a capability of said
10 server to support the request; and
11 sending the requested data associated with said streaming media data.

1 73. A machine-readable medium as in claim 71, wherein said request may be
2 made by a caching proxy server or a client.

1 75. A machine-readable medium as in claim 71, further comprising sending
2 the requested data associated with the transmission protocol in an extensible
3 extended header format.

Sub A7

76. A machine-readable medium as in claim 75, wherein said extensible extended header comprises an extension name and an extension identification (ID) associated with each separate RTP extension.

1 77. A machine-readable medium as in claim 71, wherein said request may be
2 for one or more type of transmission protocol data at a time.

1 78. A machine-readable medium as in claim 71, wherein said response by
2 the server comprising response for each supported transmission protocol data
3 and no response for any unsupported transmission protocol data.

1 79. A machine-readable medium as in claim 71, further comprising receiving
2 a request to send the transmission protocol data after sending a response for
3 supported data, and sending only the requested and supported transmission
4 protocol data.

80. A machine-readable medium that provides executable instructions, which when executed by a set of processors, cause said set of processors to perform data transmission receiving operations from a sever comprising:

sending a request for streaming media data to said server, said request including a request for data associated with said streaming media data, said

6 request including an identifier which represents one of several possible types of
7 data associated with said streaming media data;
8 receiving a response from said server indicating support for the
9 requested streaming media data;
10 informing said server to send the supported data associated with said
11 streaming media data;
12 receiving the supported streaming media data from said server;
13 receiving a request from a client to send streaming media data; and
14 sending the requested streaming media data to said client.

1 82. A machine-readable medium as in claim 80, wherein said receiving
2 streaming media data from the server is in an extensible extended header
3 format.

1 83. A machine-readable medium as in claim 80, wherein said sending a
2 request may be for one or more various and unrelated types of streaming media
3 data to be sent at a time.

89. A machine-readable medium that provides executable instructions, which when executed by a set of processors, cause said set of processors to perform RTP header extending operations comprising:

- adding a first RTP sub-extension ID to an RTP header;
- defining a length of the first RTP sub-extension by providing a sub-extension length;
- providing data corresponding to the RTP sub-extension ID within said length defined for said first RTP sub-extension; and
- having subsequent RTP sub-extensions following the first RTP sub-extension.

1 90. A machine-readable medium as in claim 89, wherein said length of said
2 RTP sub-extension being defined by a whole number of 32 bit words.

1 91. A machine-readable medium as in claim 89, wherein said first RTP sub-
2 extension immediately following the RTP header.

1 92. A machine-readable medium as in claim 89, wherein said RTP sub-
2 extension length is immediately followed by RTP sub-extension data and
3 immediately preceded by RTP sub-extension ID.

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93. A machine-readable medium as in claim 89, wherein said RTP sub-
extension contains transmit time information of each RTP packet.

1 95. A machine-readable medium as in claim 89, wherein said RTP sub-
2 extension contains RTP Frame Type information.

1 97. A machine-readable medium as in claim 96, wherein said unsigned
2 integer and frame type further comprising steps of:
3 assigning an integer value of "0" to an unknown frame type; an integer value
4 of "1" to a key frame type; an integer value of "2" to a p-frame type; and an
5 integer value of "3" to a b-frame type.

1 99. A machine-readable medium as in claim 97, wherein said p-frame being
2 less important in priority than key-frame, and more important in priority than
3 b-frame.

1 100. A machine-readable medium as in claim 97, wherein said b-frame being
2 less important in priority than p-frame.

1 101. A machine-readable medium as in claim 97, wherein said b-frame being
2 less important in priority than key-frame.

1 102. A machine-readable medium as in claim 97, wherein said unknown-
2 frame being either more or less important in priority than key-frame, p-frame
3 and b-frame.

1 103. A machine-readable medium as in claim 97, wherein said key-frame
2 being more important in priority than p-frames and b-frames other frames.

1 104. A machine-readable medium that provides executable instructions,
2 which when executed by a set of processors, cause said set of processors to
3 perform negotiating operations for various types of streaming media data by a
4 server comprising:

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5 receiving a request for one or more types of streaming media data from a
6 caching proxy server or a client, said request including a request for data
7 associated with said streaming media data, said request including an identifier
8 which represents one of several possible types of data associated with said
9 streaming media data;

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10 receiving a response to each requested type of streaming media data;
11 and
12 deciding whether to proceed or terminate negotiation process associated
13 with streaming media data.

68

Variable	Unit	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060	2061	2062	2063	2064	2065	2066	2067	2068	2069	2070	2071	2072	2073	2074	2075	2076	2077	2078	2079	2080	2081	2082	2083	2084	2085	2086	2087	2088	2089	2090	2091	2092	2093	2094	2095	2096	2097	2098	2099	2100																																																																																																																																																																																						
Population	Millions	10.0	10.1	10.2	10.3	10.4	10.5	10.6	10.7	10.8	10.9	11.0	11.1	11.2	11.3	11.4	11.5	11.6	11.7	11.8	11.9	12.0	12.1	12.2	12.3	12.4	12.5	12.6	12.7	12.8	12.9	13.0	13.1	13.2	13.3	13.4	13.5	13.6	13.7	13.8	13.9	14.0	14.1	14.2	14.3	14.4	14.5	14.6	14.7	14.8	14.9	15.0	15.1	15.2	15.3	15.4	15.5	15.6	15.7	15.8	15.9	16.0	16.1	16.2	16.3	16.4	16.5	16.6	16.7	16.8	16.9	17.0	17.1	17.2	17.3	17.4	17.5	17.6	17.7	17.8	17.9	18.0	18.1	18.2	18.3	18.4	18.5	18.6	18.7	18.8	18.9	19.0	19.1	19.2	19.3	19.4	19.5	19.6	19.7	19.8	19.9	20.0	20.1	20.2	20.3	20.4	20.5	20.6	20.7	20.8	20.9	21.0	21.1	21.2	21.3	21.4	21.5	21.6	21.7	21.8	21.9	22.0	22.1	22.2	22.3	22.4	22.5	22.6	22.7	22.8	22.9	23.0	23.1	23.2	23.3	23.4	23.5	23.6	23.7	23.8	23.9	24.0	24.1	24.2	24.3	24.4	24.5	24.6	24.7	24.8	24.9	25.0	25.1	25.2	25.3	25.4	25.5	25.6	25.7	25.8	25.9	26.0	26.1	26.2	26.3	26.4	26.5	26.6	26.7	26.8	26.9	27.0	27.1	27.2	27.3	27.4	27.5	27.6	27.7	27.8	27.9	28.0	28.1	28.2	28.3	28.4	28.5	28.6	28.7	28.8	28.9	29.0	29.1	29.2	29.3	29.4	29.5	29.6	29.7	29.8	29.9	30.0	30.1	30.2	30.3	30.4	30.5	30.6	30.7	30.8	30.9	31.0	31.1	31.2	31.3	31.4	31.5	31.6	31.7	31.8	31.9	32.0	32.1	32.2	32.3	32.4	32.5	32.6	32.7	32.8	32.9	33.0	33.1	33.2	33.3	33.4	33.5	33.6	33.7	33.8	33.9	34.0	34.1	34.2	34.3	34.4	34.5	34.6	34.7	34.8	34.9	35.0	35.1	35.2	35.3	35.4	35.5	35.6	35.7	35.8	35.9	36.0	36.1	36.2	36.3	36.4	36.5	36.6	36.7	36.8	36.9	37.0	37.1	37.2	37.3	37.4	37.5	37.6	37.7	37.8	37.9	38.0	38.1	38.2	38.3	38.4	38.5	38.6	38.7	38.8	38.9	39.0	39.1	39.2

Sub A₁ 7 110

1 110. A machine-readable medium as in claim 108, wherein determining
2 supported types of streaming media data being performed by checking if a
3 response in a form of an echo or otherwise has been sent for requested type of
4 streaming media data.

1 111. A machine-readable medium as in claim 109, wherein said execution
2 command being send based on results of checking if unsupported type of
3 streaming media data is essential to caching proxy server operations.

1 112. A machine-readable medium as in claim 108, wherein said decision
2 being to terminate negotiation process.

1 113. A machine-readable medium as in claim 108, wherein said decision
2 being to proceed with negotiation process and requesting the server to send
3 remaining supported type of streaming media data.

1 114. A machine-readable medium that provides executable instructions,
2 which when executed by a set of processors, cause said set of processors to
3 perform frame thinning operations by a caching proxy server comprising:
4 receiving a message from a client to thin frames in a streaming media
5 data transmission from said caching proxy server;
6 evaluating priority of frames; and

7

1 120. A machine-readable medium as in claim 114, wherein said unknown-
2 frame being either more or less important in priority than key-frame, p-frame a
3 b-frame.

1 121. A machine-readable medium as in claim 114, wherein said key-frame
2 being more important in priority than p-frames, b-frames, and any other
3 frames.

1 122. A machine-readable medium as in claim 114, further comprising:
2 receiving a second request from a client to further thin frames;
3 processing request and eliminating more selected frames and sending
4 frames of higher priority.

1 123. A machine-readable medium as in claim 122, wherein said selected
2 frame being eliminated being a p-frame, and sending frames with higher
3 priority than p-frame to the client.

1 124. A machine-readable medium as in claim 122, wherein said selected
2 frame being eliminated being a p-frames and b-frame, and sending frames with
3 higher priority than both p-frames and b-frames to the client.

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1 129. A machine-readable medium as in claim 125, wherein said p-frame being
2 less important in priority than key-frame, and more important in priority than
3 b-frame.

1 130. A machine-readable medium as in claim 125, wherein said b-frame being
2 less important in priority than p-frame.

1 131. A machine-readable medium as in claim 125, wherein said b-frame being
2 less important in priority than key-frame.

1 132. A machine-readable medium as in claim 125, wherein said unknown-
2 frame being either more or less important in priority than key-frame, p-frame
3 and b-frame.

1 133. A machine-readable medium as in claim 125, wherein said key-frame
2 being more important in priority than p-frames, b-frames and any other frames.

1 134. A machine-readable medium as in claim 126, wherein said eliminating
2 comprising eliminating p-frames and sending selected frames that are higher in
3 order than p-frames to the client.

Sub A₁⁷₁₃

1 136. A machine-readable medium that provides executable instructions,
2 which when executed by a set of processors, cause said set of processors to send
3 transmit time of RTP packet transmission operations from a caching proxy
4 comprising:

7 receiving said streaming media data corresponding with transmit time
8 information from the server;

transmitting from said caching proxy server to a client, said streaming
media data at times specified by said transmit time.

74

4 means for transmitting a request for data associated with said streaming
5 media data, said request including an identifier which represents one of
6 several possible types of data associated with said streaming media data;
7 means for receiving said streaming media data and storing said
8 streaming media data on a storage device which is capable of being
9 controlled by said caching proxy server; and
10 means for receiving said data associated with said streaming media data.

2 means for receiving a request for streaming media data, said request
3 including a request for data associated with said streaming media data, said
4 request including an identifier which represents one of several possible types of
5 data associated with said streaming media data;

6 means for responding to the request with a response indicating a
7 capability of the server to support the request; and

8 means for sending the requested data associated with said streaming
9 media data.

means for sending a message for streaming media data to a server, said
request including a request for data associated with said streaming media data,

Sub A₄ 7s

4 / said request including an identifier which represents one of several possible
5 types of data associated with said streaming media data;
6 means for receiving a response from the server indicating support for the
7 requested streaming media data;
8 means for informing the server to send the supported data associated
9 with said streaming media data;
10 means for receiving the streaming media data from the server;
11 means for receiving a request from the client to send streaming media
12 data; and
13 means for sending the requested streaming media data to the client.

1 140. A RTP header comprising:

2 means for adding a first RTP sub-extension ID to an RTP header;
3 means for defining a length of said first RTP sub-extension by providing
4 a sub-extension length;
5 means for providing data corresponding to the RTP sub-extension ID
6 within said length defined for said first RTP sub-extension; and
7 means for having subsequent RTP sub-extensions following the first RTP
8 sub-extension.

1 141. A server comprising:

Sub A 7

2 means for receiving a request for one or more types of streaming media
3 data from a caching proxy server or a client, said request including a request for
4 data associated with said streaming media data, said request including an
5 identifier which represents one of several possible types of data associated with
6 said streaming media data;
7 means for determining if requested types of streaming media data are
8 supported by the server; and
9 means for responding to the request with a response indicating the
10 capability of the server to support the request.

1 142. A caching proxy server comprising:

2 means for sending a request for one or more types of related or
3 unrelated streaming media data to a server, said request including a request for
4 data associated with said streaming media data, said request including an
5 identifier which represents one of several possible types of data associated with
6 said streaming media data;
7 means for receiving a response to each requested type of streaming
8 media data; and
9 means for deciding whether to proceed or terminate negotiation process
10 associated with streaming media data.

1 143. A frame thinning caching proxy server comprising:

Sub A₂ 7

2 (means for receiving a message from a client to thin frames in a streaming
3 media data transmission from said caching proxy server;
4 means for evaluating priority of frames; and
5 means for sending only selected frames.

1 144. A client comprising:

2 means for sending a message to a caching proxy server, said message
3 indicating a need to thin streaming media data received at said client;
4 means for receiving media back from caching proxy server that are
5 higher in order than low order media.

1 145. A caching proxy server comprising:

2 means for requesting data corresponding to transmit time for streaming
3 media data from a server;
4 means for receiving said streaming media data and corresponding
5 transmit time information from the server;
6 means for storing the received information; and
7 means for transmitting from said caching proxy server to a client said
8 streaming media data at times specified by said transmit time.